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PROCEEDINGS OF A SEMINAR ON THE COST ESTIMATING  
PROCESS: THE NEED FOR A C. (U) AMERICAN DEFENSE  
PREPAREDNESS ASSOCIATION ARLINGTON VA

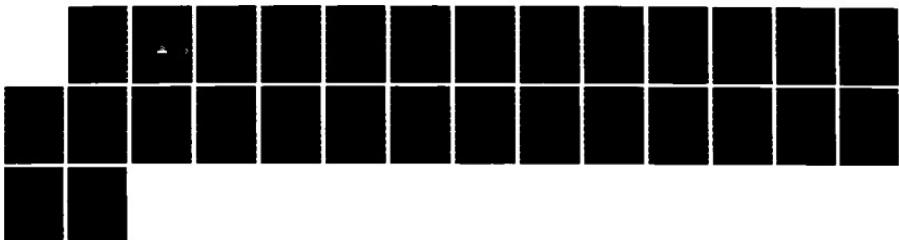
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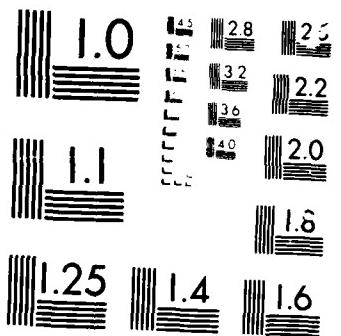
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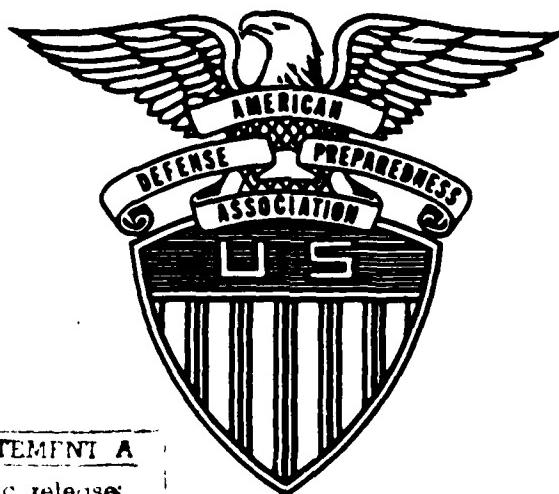
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AMERICAN DEFENSE  
PREPAREDNESS ASSOCIATION

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*Proceedings of*  
**A SEMINAR ON THE  
COST ESTIMATING PROCESS**

"THE NEED FOR A COMMON UNDERSTANDING"



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## TABLE OF CONTENTS

	PAGE
SUMMARY REPORT L. Lee Allison, Vice President Strategic Planning, United Technologies Corporation, Seminar Chairman	1
DEFENSE KEYNOTER PRESENTATION LTG Robert Moore, Deputy Commanding General for Research Development and Acquisition US Army Material Development & Readiness Command	3
INDUSTRY KEYNOTER PRESENTATION Robert Johnson, Corporate Vice President and Group Executive, McDonnell Douglas Astronautics	6
STATUS AND ARMY'S PLAN TO IMPROVE MG J.F. McCall, Comptroller US Army Material Development & Readiness Command	9
SUMMARY OF SESSION IV BUDGETING & PLANNING ESTIMATE Session Chairman: Peter D'Angelo, Assistant Division Comptroller of the Missile Systems Division Raytheon Company	11
SUMMARY OF SESSION V ENGINEERING, DEVELOPMENT AND PRODUCTION Session Chairman: Keith B. Davis, Director, Estimating & Cost Records and Control, Martin Marietta Aerospace	14
SUMMARY OF SESSION VI LIFE CYCLE COSTING Session Chairman: Mark H. Burmeister, Director, Price Systems, RCA	16
LIST OF ATTENDEES	17

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## PREFACE

It has always been the objective of the United States Government to acquire needed weapons systems on time and within previously established cost estimates. This objective however, has not always been achieved as unanticipated cost growths have been experienced. In recognition of this problem, the Army initiated a series of management reviews with senior industry executives to examine the troublesome area and seek ideas to improve the cost management and cost control process. Prominent among these reviews were the Secretary of the Army's Cost Discipline Advisory Committee; the Chicago Cost Discipline Conference; and the Atlanta Executive Seminars with Industry and DARCOM. A key element emerging from these reviews is the need for establishing sound and realistic cost estimates from the outset of any programs.

This Seminar brought together Defense and Industry managers who are involved with the development of cost estimates and who have the responsibility for cost decision making and the development of cost estimates. They are at a high enough level in their respective organizations to understand the cost estimating process and the causes of cost estimating problems. The objective was to develop a better understanding of the cost estimating problem, seek new ideas, and develop improved methods for management of the cost estimating process. Throughout the life cycle of any program, there will be a succession of various cost estimates from the initial estimates made when the program is first conceived to the final accounting of the costs to produce and operate the weapon system. Because industry has a major role in developing the initial cost estimates used in the budgeting and program process, it must share prime responsibility with Defense for producing weapon systems on time and within original cost estimates.

Discussion within this Seminar enabled Military & Industry Managers to understand how each other develop costs. The Seminar also examined the various problems in improved methods for developing and presenting cost estimates with a final objective of establishing a better understanding of this process as a vital step toward better cost management and control.

## SUMMARY REPORT

A Seminar on the Cost Estimating Process  
February 7-8, 1984, Arlington, Virginia

### Introduction

An alternate title for this seminar might be "Controlling Defense Procurement Costs - A Cost Estimating Perspective". The thrust of the program was to build on prior initiatives (like the Chicago Cost Discipline Conference and Atlanta IX) to control these costs; two presentations focused on these earlier efforts so as to set the stage for the following panels.

The panel recommendations speak for themselves. Rather than highlighting them, I want to focus on three areas which were often addressed during the seminar:

- o Problems in timely definition of program requirements.
- o The need for contingencies.
- o The major challenges of controlling ownership or operating costs.

### Program Definition

Program instability, properly, has been given a large share of the blame for cost growth. But the discussions highlighted difficulties in developing timely, crisp definition of mission requirements and system specifications as contributors to higher cost directly, and indirectly through increases in program instability downstream. It appears to industry that the process of defining requirements and specifications takes too long (several years is not uncommon). The process appears inefficient as well in requiring detailed estimates (a 4000 page BCE was cited) before the program definition is established. Inability to get program requirements clarified when estimating their cost in response to an RFQ was cited as a cause of delays as well as inaccurate estimates.

The following questions are suggested for further study:

- o Does the program definition process systematically consider the views of the field commands and the DA staff as well as TRADOC? Can industry be brought into the process earlier?
- o Are estimating techniques too standardized for use at the requirements definition stage? It appeared that the only choices are rather complex, parametric methods or detailed, bottoms-up BCE's. Is there a need for quick-turnaround estimates that can be used while iterating system definitions? Are there effective means for trading off mission effectiveness vs. cost during this period?

### Contingencies

The use of contingency provisions is widely disputed and, even when included in funding requests, they are often deleted during the approval process. Still, there was wide agreement on the selective need for contingencies and their use has often prevented overruns downstream. Three ideas were discussed which might help get contingencies better accepted and effectively used in program estimates:

- o Determine the basis for the basic estimate as precisely as possible; did it include contingencies and/or assume future (undefined) efficiency improvements?
- o Define the purpose(s) of the contingency provisions as specifically as possible; e.g., expected requirements changes, quantity increases, specific design risks.
- o "Selling" a contingency may be easier if cost performance improvement over past experience is also included in the estimate. The question of estimates based on historical costs vs. standards was discussed in this regard. The Air Force is moving toward the use of standards in cost estimates as a means of forcing cost reduction and stripping out the effect of past inefficiencies. (Incidentally, the proper use of standards as a control tool can improve actual cost performance even in job shop environments). In any event, it is dangerous to merely assume that future performance improvements will offset the need for contingencies.

#### Operating Costs

Operating expenses typically account for well over half of total program costs. There was general agreement on the need to more carefully consider these costs in determining system specifications, to establish dependable means of measuring them, and to establish incentives to control them. One basic issue that needs more study is sourcing. Just as the military customer expects a contractor to justify his make/buy decisions, a review of depot-level maintenance sourcing may be highly productive. Commercial customers are increasingly finding it cost-effective to contract for maintenance. Perhaps policies which restrict contract maintenance need to be re-evaluated, if potential savings are sufficient.

As a final thought, the seminar highlighted three key factors which have been demonstrably effective in preventing cost growth: timely, crisp program definition, estimates which include proper, carefully-defined contingencies and effective incentives for cost control and cost reduction. Although none of these factors are easy to achieve, continued efforts toward doing so are clearly worthwhile.

L. L. Allison  
Chairman

## DEFENSE KEYNOTER PRESENTATION

LTG Robert Moore  
Deputy Commanding General for Research, Development & Acquisition  
HQ DARCOM

Since the Chicago Conference in July 1982 and the Atlanta IX Conference in early March 1983, I believe it would be safe to say that we in DARCOM have made some progress towards improving our costing systems and in bringing our costs under control.

As I reread portions of ADPA'S report of the Chicago Conference Proceedings, I noted one of the Bottom Line Summary conclusions which indicated that Program Instability -- not Cost Growth -- was the primary contributor to most of our cost discipline problems. The report further observed that up to seventy-five percent of cost increases were related to program turbulence (requirements changes, program delays, and so on). I naturally agree 100 percent with that observation since I've been preaching about it at every available opportunity. Program instability is definitely our worst enemy and we must and will find ways and means to bring our programs under control.

We've got to curb our insatiable appetite that keeps adding to an already full plate. Among the 150 selected comments, 15 basic conclusions, and 31 specific recommendations reflected in parts V, VI, and VII of the Chicago Report, one Army weakness was dealt with which should warrant further attention by this group -- and I'm referring to the abilities, or lack thereof, of our acquisition people -- a deficiency that we are pursuing with vigor as part of our Materiel Acquisition Management Program. We will train and assign people throughout their careers to better prepare them as acquisition managers.

Many of the cost discipline issues raised at the '82 Chicago Conference were rehashed last March by the cost control panel in Atlanta. Following Atlanta, selected industry and Army representatives from the several panels convened follow-on meetings with General Keith, the Commander of DARCOM. The follow-on meeting for the cost control panel resulted in narrowing down some 38 suggestions to 3 basic recommendations.

One, that we improve program cost estimating, had two parts. First was to make source selections based on real cost differences rather than bottom-line bids. After considerable review of our policy and practices, we concluded that present policy guidance is adequate for the source selection process. Based on my personal experience at MICOM and in my present position, I can attest that the lowest bidder is not awarded the contract unless all technical considerations and other necessary prerequisites are met. An industry observation in the Atlanta IX report specified that "A low bid is almost invariably considered credible by the government." This simply isn't the case, particularly for our larger programs.

The second part of this recommendation sanctions the establishment of a "program definition phase" to determine firm specifications and program costs. Our MSC's wrestled a great deal with this one and came up with the pros and cons for three alternatives.

The first consists of a 2 to 6 month post-award phase to define and refine system specifications and hardware concepts. That alternative has potential legal problems that could be incurred with losers on a competitive bid, and because of the uncertainty it would inject in the initial cost estimate. We are nonetheless going to try this approach with the Howitzer Improvement Program (HIP). Alternative 2, which considered a separate requirements definition phase, was rejected on the basis that it would cost additional time and money. We're also pursuing a third alternative. We propose to award two contracts to the winner of the full scale development source selection. The first contract is for a two-to-six month contract definition phase, and it is executed immediately. The second contract is for the conventional FSD effort, but its execution is contingent upon the results of the contract definition phase. The Army may also choose to negotiate changes based on the first phase. Although this approach may take a little extra time, we feel its benefits, namely the contractor's refinement of the scope of work, technical approach and design-to-unit-production-cost (DTUPC) goals, should pay ample dividends in terms of program stability, and avoidance of technical and support problems. This alternative, I believe, is within the intent of the recommendation. We're now in the process of selecting a candidate system to use as a trial horse.

Transition of our systems from development to production has received a tremendous amount of emphasis during the past two years following some sad lessons learned during the previous 5 to 6 years. We have taken a number of positive actions to get our production engineering house in order. Probably the most important is a change to DARCOM Regulation 70-6, Productivity Engineering Planning (PEP), which really provides the needed tools to do the job right. They include fencing PEP funds in the R&D appropriations; requiring that the RFP and source selection process assess PEP separately; making PEP a separate contract line and requiring contractor accountability of PEP efforts; and requiring successful PEP completion (to include validation) as a basis for production go-ahead.

The third recommendation was based on the Atlanta cost panel's perception that contractors and their military customers are not sufficiently motivated to reduce costs. In a nutshell, the panel is saying to reward those who put forth the effort and realize cost savings, and penalize those who don't. Our study concluded that it is feasible to establish program cost control standards and measure an individual's performance against those standards. Some progress has been made towards implementing the concept in both military OER's and in civilian performance appraisals. Also, a person's performance in managing cost-related requirements of his or her job will be given equal consideration in performance appraisals to that for meeting schedules and for performing technical tasks. In addition, several efforts are underway to induce contractor cost reduction incentives, including reviewing the feasibility of translating O&S cost estimates into contractual incentives (RAM, Warranties, etc.) and examining the relationship between operational intensity and O&S cost elements.

We've putting more attention up front in acquisition planning and communication between user, developer and industry to positively influence the outcomes

when we execute the production. We also must put more money up front, like PEP, to reduce the burden of cost in production. Cost analysts and programmers must allow for this. A small investment in front-end dollars yields a much larger payoff later in production; and the better we communicate our needs and define our tradeoffs, the better acceptability our product ought to have.

Now, let me leave a challenge on the table. I believe our goal in life is to be able to document and justify at any point in the life cycle the true value of what a system should cost. Early on, we must estimate through parametric means and derive cost goals like DTUPC. The government must, fortunately or unfortunately, ask for the money for production at least three years before the first production occurs. So at best these first estimates are based on parametric analysis and not actual prices. So we must allow the DTUPC to change as the design changes; make certain we keep our conceptual estimates and baseline cost estimates as realistic as possible and not done in a vacuum from what the contractor believes. Since early production negotiations cannot be based on actual costs - in my view we must have our pricers and costers work to an independent government estimate, based on our most current DTUPC information and using parametric analyses and pricing as best we can. Industry must do likewise. Then, when we have sufficient real cost data from production, we do a full scale "should-cost study." This estimate should be relatable to our baseline cost estimate. It will let us set our sights on what the Army and industry think the item should cost off the production line.

A true "should-cost" might not occur until about the third production contract. We don't need to do a full should-cost but once. They are too expensive and too time consuming! We then re-adjust our cost curves; determine the recurring and non-recurring prices, and negotiate on the major differences. The recurring costs should not be significantly different in either industry's or the government's estimates at the time, or in any future production year negotiation. We also look to value engineering and other cost reduction methods to reduce the impact of inflation and lower the cost of the item over time. We must do something to shorten our negotiations and increase our collective faith in cost estimates and proposals. We spend too much time and resources in our negotiating and costing areas to not give our procedures (or lack thereof) concentrated attention.

ADPA SEMINAR ON THE COST ESTIMATING PROCESS

7-8 FEBRUARY 1984

SESSION II

Management's View of the Problem

Outline for Remarks By

R. L. Johnson

Corporate Vice President - Group Executive  
McDonnell Douglas Corporation

I. INTRODUCTION

Importance of solving cost growth problem

National defense posture capability

Specific program survival and endurance

General company and industry reputation

A recognized problem - many years

Many attempts to solve - four most recent

SecArmy Cost Discipline Advisory Committee

ADPA Panel - Overplan Costs of Army Programs

Chicago Cost Discipline Conference

Atlanta IV ADPA/DARCOM Conference

Problem - more fundamental than technique or discipline

Mr. Johnson covered:

Highlights of above conferences - in which involved

ADPA Panel and Chicago

Some comments on personal lessons learned

## II. ADPA PANEL - '81/'82 (Study at VCSA request)

### IMPORTANT PROBLEM AREAS/RELATED SOLUTIONS

1. Inadequate system and program definition
2. Inadequate Program Funding
3. Government Program Manager Continuity Experience and Tenure
4. Erosion of Government Program Manager's Authority
5. Insufficient Contractor Internal Discipline
6. Inadequate Attention to Production Cost
7. Inadequate Preparation for Development/Production Transition
8. External Forces

### RECOMMENDED ACTIONS

1. Modify FSED source selection evaluation critieria so that the only cost considerations are factors that are different for each proposer.
2. Initiate FSED with a definition period in which the Army and the winning contractor thoroughly define the system and program, together with instant contract costs and budgetary total program costs including expected reserve requirements.
3. Take actions to provide incentives for and direction of a material program manager career path.
4. Provide for program oversight techniques to ensure contractor attention to important areas requiring internal discipline.
5. Recognize that achieving acceptable production unit costs for new equipment is a continuing process and establish methods for guiding the process and using the output information.
6. Recommend to DOD/Congress that FSED validate not only the product design but also the production process and provide funds to bridge the gap between development and production.

### III. ADPA/ARMY CHICAGO COST DISCIPLINE CONFERENCE - MID '82

#### BOTTOM LINE CONCLUSIONS

1. Basic cause of cost growth is Program Instability
2. Program Instability Causes
  - o Technical complexity not fully understood
  - o Level of risk and resulting potential cost problems not fully appreciated
  - o Resolution of problems associated with large performance gains.
3. Highly competitive environment in DOD and industry contributes to problem
4. Inflation is a second-order effect.

#### BOTTOM LINE RECOMMENDATIONS

1. Army should concentrate its efforts on Program Instability Problem.
  - a. By adequate system definition by combined team of single developing Contractor and Army at beginning of FSED.
  - b. Resist performance and technological improvements after FSED initiation.
  - c. Insist on good Contractor discipline.
  - d. Budget and track production cost during development phase
  - e. Manage program and all problems in a cooperative Contractor/Army team fashion.
2. Army should acquire capability to better assess technical uncertainties and associated cost risk.
3. Army should (after accomplishing 2. above)
  - a. Balance requirements and costs
  - b. Program adequate time and funds to accommodate level of technical uncertainty.
  - c. Place less emphasis on cost level in evaluating competitive proposal for development program.

#### IV. PERSONAL LESSONS LEARNED

1. Early discussion with senior service officials  
Technical and funding pressures
2. Generation of an Army/Contractor cooperative approach early
3. Faster action together with Army when problems appear
4. The basic and underlying "cultural" problems leading to the under estimation of program costs will be very difficult to solve.

## SUMMARY REPORT

### Military Cost Estimating Conference - Status and Army's Plan to Improve

The following report summarizes my presentation to the American Defense Preparedness Association (ADPA) Cost Estimating Symposium in Pentagon City, Virginia, 7-8 February 1984. The report outlines the general process, actions on going to improve the process, and remaining problems and issues. At the request of the chairman, it has been reduced to two pages.

PROCESS. The Army cost estimating process is well managed and improving. It constitutes a family of estimates which develop over the life cycle of the weapons system. The estimates are complimentary and interactive. The initial estimate supports a cost and operational effectiveness analysis which assesses the benefits and costs of several alternatives. The alternatives may describe ways of dealing with a threat, exploiting new technology, or a combination of the two. After selection of the most cost-effective alternative, the cost element of the equation is translated into the baseline cost estimate (BCE). This estimate from the outset lays out the total program costs; research, development, test, and evaluation (RDTE), procurement and military construction funds needed to develop and procure the system; and military personnel, procurement and operation and maintenance funds needed to field and sustain the system. The "reasonableness" of the BCE is cross-checked by an Independent Cost Estimate (ICE) prepared by an impartial team. The BCE is translated into a budget using the most likely point estimate as the budget submission to DOD and the Congress. The BCE also serves as a benchmark for contractual actions such as source selection boards and should cost teams.

IMPROVEMENT. The following improvements are being made or have been made recently in the process.

a. Annual Update of the BCE. The estimates are updated annually as a minimum. This replaces a procedure of updating a major developmental milestone which tends to occur 3-4 years apart.

b. Restructure of the BCE. Baseline estimates have been restructured to clearly identify the funds required in each Congressional appropriation, i.e., RDTE, Military Construction Army, etc. This action facilitates a crosswalk into the budget.

c. Restructure and Emphasis on the Materiel Systems Requirements Specification (MSRS). The MSRS has been restructured to more clearly describe the capabilities and characteristics of the system. The MSRS, which precedes each BCE, outlines exactly what is to be costed.

d. Improved Methodology via Contractual Support. Over \$3M in contracts have been let in FY 83 and FY 84 to improve the quality of data bases and bring methodology to the state of the art. Continued expenditure and major resources are planned.

e. Linkage to the Budget. A special subcommittee of the Army Staff Program Budget Advisory Committee (PBAC) now insures that all system acquisition decisions are translated into the budget.

f. Linkage to the Contracting Process. That portion of the BCE which lays out data of value prior to contract negotiations has been expended. The BCE now clearly identified design to unit production cost of the system, unit cost of components, and estimates of labor and material where possible.

g. Standard Inflation Methodology. The Army Staff has developed a method based on standard industrial codes which calculates the historical inflation incurred during system development. This is an important calculation to permit comparison with inflation indices and contract inflation clauses.

4. WEAKNESSES. The major weaknesses of the process are:

a. Insufficient Personnel. Due to shortage of personnel, we are unable to provide dedicated cost analyst cells for many high dollar project managers. Although these managers receive support from their local cost offices, the size and criticality of the projects dictate dedicated support.

b. The Inconsistencies in Estimating Formats and Processes Between the Military Departments. Many defense suppliers have a legitimate complaint that dealing with the Army, Navy and Air Force requires three different types of data and responses in three different formats. The suppliers ask if they can get an annual calendar of requirements and avoid crash efforts. The move by the Army to a new cost estimating format is a specific example of this problem.

c. Difficulty of Defining the "User." It appears to industry estimators that many people within the Army claim to speak for the "user." All of these user representatives have the authority to request a new estimate.

d. Contractor Support Versus Government Maintenance. There is no agreement as to the relative cost effectiveness of contractor support versus government maintenance during the fielding and sustaining of a weapon system. There is no model or methodology which conclusively lays out the variables. Each case must be studied on its own merit, but the estimating process contains variables for organic maintenance only. Contractor personnel believe they should be able to submit the estimates, which the Army would believe, for contractor maintenance.

SUMMARY. Many informal contacts were made with industrial cost estimators. These contacts proved very beneficial. DARCOM and DA must complete the improvements outlined above and develop strategies to deal with the weaknesses.

ADPA Seminar on the Cost Estimating Process  
"The Need for a Common Understanding"

SESSION IV - BUDGETING & PLANNING ESTIMATE

PANEL MEMBERS

Chairman - Peter D'Angelo, Assistant Division Controller,  
Missile Systems Division, Raytheon Company

Members - Russell Feury, Chief Cost Analysis Division,  
US Army Tank Automotive Command

- Col James Welsh, Project Manager, Mobile Protected Gun, US Army Tank Automotive Command
- Fred Sheffey, Director of Engineering Administration, Missiles & Advanced Program Division, Vought Corporation
- William Benfer, Manager Contract Services/ Government Affairs, Texas Instruments

PURPOSE OF PANEL

Examine, from Industry and Army points of view, the process and problems involved in improving the initial program budgeting and planning estimates, and discuss actions which might be taken to improve the accuracy of the process.

CONCLUSIONS:

1) Parametric Modeling, learning curves, and other data base oriented estimating techniques can be effective cost estimating tools. One of the most significant problems in the estimating process is limited program definition in the initial budgeting and planning stages of a program.

2) Program Cost drivers as well as system cost drivers must be identified "early on" and tracked during the program initiation and demonstration/validation phases of a program. These factors are significant contributors to the cost growth problem.

3) In many cases, there is limited or no industry participation until the exploratory R&D phase of a program. Industry can provide the Army with additional tools and insight in the early planning stages of a program.

4) Historically, initial estimates have been optimistic in that they tend to reflect a success oriented program without adequate consideration for program risks such as delays, technical concerns/changes, and system performance risks. However, the thrust of the Army today is to avoid such an approach. For example, the MPGS PM went to considerable effort to reflect a realistic program in his Baseline Cost Estimate (BCE). Furthermore, the Independent Cost Estimate (ICE) concept has been developed to test the reasonableness of the PM's BCE and to assure realistic program cost. The ICE concept was applied in the case of the MPGS, resulting in a second opinion confirming such reasonableness. In conjunction with this initial estimate a draft outline of test and evaluation, ILS and acquisition strategy plans must be developed, at least through the initial fielding stage of the proposed program.

RECOMMENDATIONS:

- 1) In order to develop a sound cost estimate "early on", that is prior to DSARC I, a Study Plan must be developed, reviewed, and approved. This plan must serve as a "stake in the ground" for the initial estimate and must clearly identify all of the principle program costing assumptions such as hardware definition, program schedules, acquisition strategy, etc. The technical and program managers, users, and cost estimators must be involved in the process. Also, there needs to be more data base development as the basis for parametric modeling and other cost estimating tools. This can be accomplished with Industry and the Army working together in the design of computer software for an Automated Cost Data Base (ACDB) and investigating and analysis of all pertinent documents for capturing costs for input into such an ACDB in accordance with the requirements of the Army Cost Analysis Program.
- 2) The key cost drivers must be identified "early on" in this process. Program cost drivers, such as development/production schedules and acquisition strategy, as well as system cost drivers such as performance requirements, new technologies, and expensive system and system integration elements must be highlighted. A "tracking system" which assesses the impact of changes to the initial set of costing assumptions must be implemented. Estimates must be updated on a timely basis to ensure a "closed loop" system whereby the decision makers are fully aware of the cost/benefit impact of proposed program changes. We recommend that the present Program Management Control System (PMCS) also be utilized as an element of this tracking system and that evolution of cost estimates be analyzed and reconciled to ensure that a "closed loop" system in place. A tracking system in the conceptual phase of a program can also provide the early-on production unit cost visibility so necessary during this process.

3) Industry participation on a study/support basis should be considered in the initial program planning stage. While the Army has a broader data base than any single contractor, a particular contractor may have more "vertical" visibility within a particular product line. This represents a potentially valuable resource that could be tapped when circumstances dictate that this course of action be pursued.

In the early stages of some program starts, this can be accomplished by the use of Management Consultants working with Industry to assist the Army in the development of acquisition plans and strategy. "Program Briefings" to Industry, similar to those conducted by the various commodity commands for RFP's, should also be considered for the purpose of soliciting comments from Industry regarding improvements to the development and acquisition strategy. These Program Briefings should be conducted prior to or in parallel with development of RFP's and other documentation necessary for the initial ASARC decision makers.

4) A risk assessment must be performed and included with all estimates. The level of detail will vary in the earliest estimates commensurate with the program specificity, however, program and system cost drivers must be addressed at all stages. Given that Program stretchs/delays will occur for example, contingencies must be included in the initial estimate for this purpose.

Funding for these contingencies should be "fenced" at higher levels within the Army to ensure that they do not become self-fulfilling prophecies but rather enhance the visibility of the decision makers and key management personnel.

5) Communications with key DOD personnel and Congressional personnel must be improved to the point that program rationale, assumptions and risks are clearly identified. In this manner the Program Manager will be better armed to resist changes to the program and, any changes that occur will be better documented as to their origin and impact.

A SEMINAR ON THE COST ESTIMATING PROCESS "THE NEED FOR A COMMON  
UNDERSTANDING," FEBRUARY 7-8, 1984

Summary Report on the Recommendations from Session V - Engineering Development  
and Production

Panel V, which was made up of Army, Air Force, and Industry participants concentrated its efforts on the estimating process during engineering development and production.

Contractor estimates, per se, were determined by the Panel to generally be of high quality given the requirements and assumptions on which the estimates were based; and they were considered to be the least responsible element for contract overruns.

However, the need for improvements in the estimating process itself was recognized as a real issue. Specific areas that our recommendations for improvements in the process addressed should be a step towards better cost management and control.

One of the key items that tended to come up across many areas we evaluated as in need of improvement was the ever prevalent issue of communication. Communications between the Army and the contractor, between contractor management and contractor program personnel, between government estimators and contractor estimators, between government/contractor design engineers and government/contractors estimators, the list goes on and on. Our first recommendation specifically addressed this issue and it is an integral part of several of the other recommendations.

Another item which seemed to be prevalent in several areas discussed was the need for an earlier flow of estimating data from contractors to the government. We suggest adding a data requirement to AD and/or ED phase contracts to require contractors to provide contractor estimates of the program under development (CCE's - ICE's - Contractor Cost Estimates - Independent Contractor Estimates). This would bring into focus two issues - earlier involvement by the contractors estimating discipline and normal management review of the estimating process as well as providing the government with another data point for determining the programs expected cost.

The Army's use of an Operational Baseline Cost Estimate (OBCE) is a recommendation that is currently in process of being implemented within the Army. The panel members felt that although the apparent emphasis on the mechanization did not necessarily in itself improve the quality of the numbers, it does however provide a powerful tool for the program management office to use in keeping their BCE current which should result in better control and management of the program.

Should cost efforts on the part of the government was discussed both in views of the Air Force and by the Army - it was a general opinion that the feedback of data upon conclusion of the should cost team's review was either late in coming or initially at such a summary level that there was not an understanding of the should cost team's basis from which a contractor could respond. In addition, our last recommendation is one that I believe should be addressed before it grows to such a magnitude of paper as to further erode the focus on the quality the estimate vs. the quantity of data that only segregates and categorizes, etc., etc., that result in volumes of paper as part of cost responses to RFP requirements. Whereas more emphasis should be placed on improving the definition of requirements, the basis upon which the estimate is based and the assumptions made in the preparation of the estimate.

Below is a listing of our recommendations.

1. Communications - Function to Function

Establish a professional estimating interchange forum between the Army and industry with a charter to improve on the tools and techniques.

2. Operational Baseline Cost Estimate (OBCE)

Program managers should implement the OBCE, thereby maintaining a dynamic baseline cost estimate.

3. Independent Cost Estimates

Formalize the budgeting process by soliciting formal industry independent cost estimates

4. Should Cost Estimates

Require prompt detail feedback to contractors at completion of the should cost review

5. Quality vs. Quantity in Terms of Cost Volume Required Responses to RFP's

Reduce the amount of required response to segregate cost data that doesn't contribute to its quality.

## SESSION VI - LIFE CYCLE COSTING

Chairman: Mark H. Burmeister

Director  
PRICE Systems  
RCA Corporation

### Panel Members:

BG Ronald K. Andreson	Deputy Commanding General for Research and Development U.S. Army Aviation Systems Command
Edward B. Fritz	Assistant Controller for Pricing Sikorsky Aircraft Division United Technologies Corporation
Frank A. Shelden	Cost Analysis Manager Ordnance Engineering Division FMC Corporation
G. Norman Stanard	Chief, Developmental Cost Analysis Directorate for Plans and Analysis U.S. Army Aviation Systems Command

### Introduction

In the life cycle of a weapons system, by far the most expensive phase is the fielding and sustainment of the weapons system. Yet, it is this phase of the life cycle which has the poorest quality historical cost data base from which future cost estimates may be generated. The panel focused upon the need to identify cost drivers early-on, and the value of conducting early cost trade-off studies to gain relative cost indications if not accurate cost magnitude projections. A special presentation on the Black Hawk program illustrated the dramatic effect of reliability on sustainment costs, which further emphasized the need to identify the cost drivers prior to the start of detailed design.

### Discussion

System configuration or hardware selection along with the maintenance and support concepts established for the system will determine most of the ultimate life cycle cost of that system. This determination is made so early in the conceptual stage that:

- 1) Few, if any, details of the actual hardware are known which causes the problem of bottoms-up estimating to be difficult to solve.
- 2) Any cost estimates pertaining to fielding and sustainment can be little more than educated guesses.

## SESSION VI - LIFE CYCLE COSTING

In view of the foregoing, greater emphasis should be placed on the use of parametric modeling techniques to assess the relative costs of alternative configurations. Even though total costs will still be uncertain, at least the most cost effective alternatives can be quickly identified, and some degree of assurance that lower costs will be achieved ultimately, even if total costs are still unknown.

Using models for cost discriminating purposes can be done in the absence of any substantial historical cost data bases. However, to use models for cost magnitude purposes with a high degree of confidence, better cost data bases must be built. Much of the mechanism for collecting standard inputs for parametric models is already in place (e.g., DD 2089), but the use of these mechanisms is not universally observed.

### Conclusions

Lack of current and significant historical cost data bases for sustainment costs hampers the use of cost magnitude models and reduces the degree of confidence in their results. Early-on bottoms-up estimating is inaccurate, and historically, has been more harmful than beneficial. Greater emphasis should be placed on the use of cost discriminating models to influence design and fielding considerations.

### Recommendations

- 1) Expand the use of parametric cost models early-on to influence initial system design, production and fielding decisions.
- 2) Establish data bases for ownership cost as well as for development and production costs, but recognize that technology causes obsolescence in areas.
- 3) Develop a standard measurement modeling policy for all the Armed Services, e.g., use existing forms like DD 2089 universally.
- 4) Put more emphasis on DTLC cost incentives to contractors. Re-evaluate current incentive policies which sometimes result in counter-DTLC incentives.
- 5) In addition to evaluating project related logistics concepts for cost effectiveness, the non-project related logistics structure may have been outdated by technology, and should be re-examined in that light.
- 6) Publish a Program Management calendar so that industry knows due dates, and will have the time to plan for and respond with better estimates.

L LEE ALLISON  
UNITED TECH. CORP  
VICE PRES - STRATEGIC PLNNG  
ONE FINANCIAL PLAZA  
HARTFORD CT 06101

BG RONALD K ANDRESEN  
US ARMY BLACK HAWK PMO  
PRO MGR  
4300 GOODFELLOW BLVD.  
ST LOUIS MO 63120

BILL BECKHAM  
FN MANUFACTURING INC  
VP FINANCIAL/ADMIN  
P O BOX 104  
COLUMBIA SC 29202

MIKE BELL  
PACIFIC CAR & FOUNDRY CO  
MGR PLANNING & ESTIMATING  
1400 N 4TH STREET  
RENTON WA 98055

JACK N BEST  
GENERAL DYNAMICS CORP  
DIR PRODUCTIVITY  
7733 FORSYTH  
ST LOUIS MO 63105

FRED BIERY  
THE ANALYTIC SCIENCES CORP  
SUITE 1220  
1700 N MOORE ST  
ARLINGTON VA 22209

ALVIN BOUDREAUX  
NAVAL TRAINING EQUIP CTR  
ATTN: DRCPM-TND-IEM  
ORLANDO FL 32813

THEODORE J. BREEN  
ARDC, AMCCOM  
DRSMC-RAC(D),  
BLDG 1/4-4  
DOVER NJ 07801

W A BRUZEK  
DETROIT DIESEL ALLISON  
ADMIN APPROPRIATIONS  
13400 W OUTER DR  
DETROIT MI 48239

ROBIN L. BRYAN  
ADVANCED TECHNOLOGY  
COST ANALYST  
20306 GRAZING WAY  
GAIITHERSBURG MD 20878

JOSEPH CALIENDO  
KAMEN AEROSPACE  
OLD WINDSOR RD  
P O BOX 2  
BLOOMFIELD CT 06002

JOHN L CARTER  
US GENERAL ACCOUNTING OFFICE  
SENIOR EVALUATOR  
441 G ST. NW, RM. 6478  
WASHINGTON DC 20548

WILLIAM CLARK  
ROCKWELL INTERNATIONAL  
VP/WASHINGTON REP  
1745 JEFF DAVIS HWY-STE 1206  
ARLINGTON VA 22202

STEVE CLUPHF  
PACIFIC CAR & FOUNDRY CO  
SR ESTIMATOR  
1400 NORTH 4TH STREET  
RENTON WA 98055

MACLEAN CROWELL  
PRATT & WHITNEY AIRCRAFT  
SUPV PROD COST ENGRG  
P O BOX 2691  
WEST PALM BEACH FL 33402

PETER R D'ANGELO  
RAYTHEON COMPANY  
ASSISTANT DIV CONTROLLER  
HARTWELL RD  
BEDFORD MA 01730

LOWELL R DAVIS  
BOEING AEROSPACE  
P O BOX 3999, M S 2E-84  
SEATTLE WA 98124

DONALD E. DAY  
US GAO  
MASAD/SDA, RM 5476  
441 G STREET, N W  
WASHINGTON DC 20548

ARTHUR L DOYLE  
KMCO INC  
5200 GREENSBORO DRIVE  
SUITE 301  
MCLEAN VA 22102

NANCY ENAULT  
MANTECH CORP  
STAFF ENG  
1764 OLD MEADOW LANE  
MCLEAN VA 22102

RUSSELL FEURY  
US ARMY TACOM  
CHIEF COST ANALYSIS DIV  
WARREN MI 48090

WILLIAM D FIRMAN  
MARTIN MARIETTA AEROSPACE  
DEP DIR EST CONTRACTS  
SAND LAKE ROAD  
ORLANDO FL 32750

TERRY C. BARKER DETROIT DIESEL ALLISON MGR, PURCHASE ADMIN P O BOX 894, MC J16 INDIANAPOLIS IN 46206	PAUL C. BAYRUNS TELEDYNE PRODUCIBILITY MGR CUMMINGS PARK, MS 44 HUNTSVILLE AL 35807
WILLIAM L BENFER TEXAS INSTRUMENTS INCORPORATED MGR CONTRACT SERVICES P O BOX 226015 MS 3131 DALLAS TX 75266	JOHN N. BERRY WESTINGHOUSE ELECTRIC P O BOX 1693 MS 1220 BALTIMORE MD 21203
ROBERT O BLACK US ARMY DARCOM PRINC ASST DEP R. D. & A 5001 EISENHOWER AVE ALEXANDRIA VA 22333	GARY R. BLISS ADVANCED TECHNOLOGY SR COST ANALYST 2414 CHESTNUT ST FALLS CHURCH VA 22340
JAMES E BROWN GENERAL DEFENSE CORP FLINCHBAUGH DIV/CV CHPT DIR BOX 127 RED LION PA 17356	WILLIAM H. BRUNING GRUMMAN AEROSPACE SR OPERATIONS ANALYST MS C27-005 BETHPAGE NY 11714
D BUKOWSKI KAMAN AEROSPACE CORP MGR COST CONTROL OLD WINDSOR RD PO BOX 2 BLOOMFIELD CT 06002	MARK H. BURMEISTER RCA PRICE SYSTEMS DIRECTOR BLDG. 204-1, ROUTE 38 CHERRY HILL NJ 08002
COL. S. D. CASS US ARMY MICOM PROJECT MGR HELLFIRE REDSTONE ARSENA AL 35808	DAVE CATLIN LOCKHEED AUSTIN DIV (LMSC) PRICE EST & BUDGET ADMIN P O BOX 17100 AUSTIN TX 78760
THOMAS J. COONCE ADVANCED TECHNOLOGY COST/FINANCIAL ANALYST 2316 N VERNON ST ARLINGTON VA 22207	TOM CRITTENDEN HQ DARCOM CHF, METHODOLOGY & DATA BR 5001 EISENHOWER AVE ALEXANDRIA VA 22333
COL. HARRY DANIELS USA BELVOIR R&D CENTER ATTN: DRCPMPSE FT BELVOIR VA 22060	KEITH B. DAVIS MARTIN MARIETTA AEROSPACE DIR. EST & COST RECORDS & CTRL 6801 ROCKLEDGE DR BETHESDA MD 20817
WILLIAM E. DEPUY, JR MGMT CONSULT & RSCH 5113 LEESBURG PIKE STE 509 FALLS CHURCH VA 22401	MR R E DEYO HUGHES HELICOPTERS SUMMA CORP MS 272041 CENTINELA & TEALE STS CULVER CITY CA 90230
RCLAND ENNO FMC NORTHERN ORD DIV ASST MGR COST ANALYSIS 4800 E RIVER RD MINNEAPOLIS MN 55421	ALBERT L. FERZACCA MARTIN MARIETTA AEROSPACE DIR. ARMY PROGRAMS 5801 ROCKLEDGE DRIVE MP320 BETHESDA MD 20834
JOHN FISCHER GENERAL DEFENSE CORP MGR CONTRACTS FINANCIAL PLANN P O BOX 127 RED LION PA 17356	DAVID M FITZGERALD FITZGERALD & ASSOCIATES WASHINGTON REP 900 17TH ST NW SUITE 1020 WASHINGTON DC 20006

DAVID H. FOLTZ  
ROCKWELL INTERNATIONAL  
MGR PRICING MISSILE SYS  
1500 SATELLITE BLVD  
DULUTH GA 30136

A. M. FRAGER  
INFORMATION SPECTRUM  
VICE PRESIDENT  
1745 S JEFFERSON DAVIS HWY  
ARLINGTON VA 22202

DONALD R GIBBS  
E-SYSTEMS INC  
7700 ARLINGTON BLVD  
FALLS CHURCH VA 22046

A. GILAAD  
EATON CORP, AIL DIV  
GROUP LEADER  
COMMACK ROAD  
DEER PARK NY 11729

EDWIN GREINER  
US ARMY DARCOM  
ATTN DRCDMR  
5001 EISENHOWER AVE RM 10506  
ALEXANDRIA VA 22333

C. E. GRUBBS  
FORD AEROSPACE & COMM  
MGR PROPOSAL PRICING DEPT  
P O BOX A  
NEWPORT BCH CA 92260

W. D. HALLAHAN  
MCDONNELL DOUGLAS ASTRO  
DIR ESTIMATING  
5301 BOLSA AVE  
HUNTINGTON BCH CA 92647

RICHARD J HAPPIK  
CHAMBERLAIN MFG CORP  
WASHINGTON REP  
2361 JEFF DAVIS HWY STE 600  
ARLINGTON VA 22202

LARRY E HOOVER  
SIMMONDS PRECISION  
MGR OF LOGISTICS  
1525 NW 167  
MIAMI FL 33169

TRUMAN W. HOWARD, III  
US ARMY MICOM  
ATTN DRSMI-FC  
REDSTONE ARSENAL  
HUNTSVILLE AL 35899

BETH JACOBSON  
ADPA  
1523 CAROLINE ST., NW  
WASHINGTON DC 20009

ROGER E JANOVSKY  
EMERSON ELEC & SPACE  
SR STAFF SPEC  
8100 W FLORISSANT  
ST LOUIS MO 63136

PETER B. KENYON  
AVCO  
V.P. TACT SYS  
201 LOWELL ST  
WILMINGTON MA 01887

JOSEPH A. KEY  
US ARMY ERADCOM  
PROJECT OFFICER, MANTECH  
ATTN: DELET-RM  
FT MONMOUTH NJ 07703

CHARLES W. LEAVERTON  
ANALYTICAL SYS ENG CORP  
CHF BUS MGMT DIV  
1754 THE GREAT ROAD  
BEDFORD MA 01730

JOHN LEE  
AVCO LYCOMING DIV  
MGR MACH & JOINING TECH  
550 S MAIN ST  
STRATFORD CT 06497

DONNA LIND  
SG&G WASCI  
SUITE 801  
2241 JEFFERSON DAVIS HWY  
ARLINGTON VA 22202

HAL LINDGREN  
SIMMONDS PRECISION  
VICE PRES LOGISTICS  
1525 NW 167TH ST  
MIAMI FL 33160

H E LOVELACE  
ROCKWELL INTERNATIONAL  
MKTG MGR  
400 COLLINS RD NE  
CEDAR RAPIDS IA 52498

ALLEN D LUEDKE  
HONEYWELL INC  
600 2ND STREET, N  
HOPKINS MN 55343

SALVATORE MAGNANO  
SANDERS ASSOCIATES, INC.  
V P ADMIN & CONTROL  
NCA 1-4240, 95 CANAL ST  
NASHUA NH 03061

GARY C MAHAN  
WESTINGHOUSE  
MGR ADV PROGRAMS  
PO BOX 746 MS 200  
BALTIMORE MD 21203

ED B. FRITZ  
SIKORSKY AIRCRAFT DIVISION  
UNITED TECH. ASST COMPT PRICING  
N MAIN STREET  
STRATFORD CT 06601

DEAN G GERETTI  
KOLLMAN INSTRUMENT CO  
VP AND CONTROLLER  
DANIEL WEBSTER HWY S  
MERRIMACK NH 03054

T. R. GREBIK  
GENERAL DYNAMICS LAND SYS  
PROPOSAL MGR  
850 STEPHENSON HWY  
TROY MI 48083

ROY D GREEN  
DEPT OF ARMY  
ASST DEP FOR PROG  
5001 EISENHOWER AVE  
ALEXANDRIA VA 22332

LARRY GSCELLMAN  
MITRE CORP  
MS W743  
1820 DOLLY MADISON BLVD  
MCLEAN VA 22102

LAWRENCE GUTHRIE  
SYS DEVEL CORP  
3216 ELLENDA AVE  
LOS ANGELES CA 90134

SUZANNE HAUB  
EG&G WASCI  
SYSTEMS ANALYST  
2341 JEFFERSON DAV HWY STE 801  
ARLINGTON VA 22202

W. BRUCE HOLT  
ADPA  
ROSSLYN CENTER, STE 900  
1700 N. MOORE STREET  
ARLINGTON VA 22209

J C HUPP  
AEROJET  
MGR OF MANUFACTURE  
1100 W HOLLYVALE ST  
AZUSA CA 91702

JOHN C. INDELICATE  
ADV SCOUT HELICOPTER  
PROJ MGRS OFF  
4300 GOODFELLOW BLVD  
ST LOUIS MO 63120

ROBERT JOHNSON  
MCDONNELL DOUGLAS CORP.  
CORP V. P., GRP EXEC  
3855 LAKEWOOD BLVD  
LONG BEACH CA 90846

ANNE KELSEY  
FORD AEROSPACE & COMM  
SR RES & DEV ENGR  
FORD RD  
NEWPORT BEACH CA 92660

AL LARIVIERE  
COLT FIREARMS  
P O BOX 1868  
HARTFORD CT 06102

NORMAN LASTOVICA  
KOLLMAN INSTRUMENT CO  
DIR OPERATIONS ADM.  
220 DANIEL WEBSTER HWY  
MERRIMACK NH 03054

RICHARD T LEE  
LOCKHEED ELEC CO  
MGR QA ENGINEERING  
1501 US HIGHWAY 22 C5#1  
PLAINFIELD NJ 07061

ROBERT O. LEWIS  
HONEYWELL INC.  
SENIOR PROCESS COST ESTIMATE  
600 2ND STREET, NE  
HOPKINS MN 55243

COL PETER S LOIZEAUX  
US ARMY  
PROD MGR  
USAMRDC FT DETRICK  
FREDERICK MD 21701

MIKE LOUBE  
HARRY DIAMOND LABS  
2800 POWDER MILL RD  
ADELPHI MD 20783

COL JOHN J MADIGAN  
US ARMY  
4930 SANQUORT LANE  
ANNANDALE VA 22003

COL EUGENE F MADIGAN  
HQ TRADOC  
DIRECTOR SYSTEMS MANAGEMENT  
DIRECTORATE  
FORT MONMOUTH VA 28511

DAVID MARCHAND  
CRAWFORD & RUSSELL  
COMM MGR  
17 AMELIA PL  
STAMFORD CT 06905

JAMES L MAY  
VITRO CORP  
PROGRAM ENGR  
14000 GEORGIA AVE  
SILVER SPRING MD 20910

MG JAMES F MCCALL USA US ARMY DARCOM COMPTROLLER 3001 EISENHOWER AVE ALEXANDRIA VA	22333	THOMAS E MC GUIRE CHIEF PROGRAM MANAGEMENT DIV PPRO, PM, TMDE-P FT. MONMOUTH NJ	07723
MARY MINOR USA DARCOM 3001 EISENHOWER AVE ALEXANDRIA VA	22333	THOMAS E MITSOCK ARDC, AMCCOM DRSMC-RAC (D) BLDG 1 1/4-4 DOVER NJ	07801
THOMAS D MORLEY BMY MGR CONTRACT ACCTG P O BOX 1512 YORK PA	17405	JOHN W. MORRISON, JR REMINGTON ARMS CO., INC. CHIEF PROCESS ENGINEER LAKE CITY ARMY AMMUNITION PLANT INDEPENDENCE MO	64150
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RICHARD O'TOOLE JET PROPULSION LABORATORY SECTION MANAGER MS 506-316, 4800 OAKGROVE DR PASADENA CA	91103	MGEN JOHN B OBLINGER, JR USA US ARMY TRADOC DEP CHIEF OF STAFF COMBAT DEV ATCD-ZA HQ TRADOC FORT MONROE VA	23651
MACK R PERRY DEPT OF NAVY NAVAL TRAINING EQUIPMENT CNTR ORLANDO FL	32813	HARRY E. PETERSON, JR GENERAL DYNAMICS/ELECTRIC BOFA MANAGER OF ILS ENGINEERING EASTERN POINT ROAD GROTON CT	06340
BRYAN H RAVERT FORD AEROSPACE & COMM DIVAD DIV FORD RD NEWPORT BCH CA	92660	CHARLES ROBERTS KOLLMAN INSTRUMENT CO MGR GOVT ACCTG 200 DANIEL WEBSTER HWY MERRIMACK NH	03054
F D ROSSI DETROIT DIESEL ALLISON ADMIN INT'L FINANCE 13400 W. OUTER DRIVE DETROIT MI	48239	ALFREDO O. ROTZ FMC CORP DEF EQUIPM GRP 1105 COLEMAN AVE, BOX 1201 SAN JOSE CA	95108
M SCHWEITZER EATON CORP, AIL DIV DIRECTOR COMMACK ROAD DEER PARK NY	11729	JAMES SEIDEL GRUMMAN AEROSPACE CORP MGR AIRCRAFT PROGRAMS ESTIMATING TECHNOLOGY	11714
FRANK SHELDON FMC CORPORATION ORDNANCE DIVISION 1105 COLEMAN AVENUE SAN JOSE CA	95108	STEVE SHELLEY HQ USAF/ARDCM CONTRACT ADMIN & INDUS RELATION DIREC CONTRACTING & MFG POLIC WASHINGTON DC	03034
CHARLES E SKUBAS AVCO LYCOMING MGR IP/ICES FINANCE 550 SOUTH MAIN ST STRATFORD CT	06497	ERNEST A SMART BDM CO 1010 EXECUTIVE CTR STE 201 ORLANDO FL	32002

JAMES R MCMINN  
TELEDYNE CONTINENTAL MOTORS  
MGR PRODUCT PRICING  
76 GETTY ST  
MUSKEGON MI 49442

GEN HENRY A MILEY JR USA RET  
ADPA  
BOX 148F  
COVE POINT ROAD  
LUSBY MD 20657

T MOLANDA  
THE SINGER CO.  
LINK DIV  
INDUSTRIAL PARK DEPT 550  
BINGHAMTON NY 13902

LG ROBERT L MOORE USA  
US ARMY DARCOM  
DPTY CG R&D DEVEL  
5001 EISENHOWER AVE  
ALEXANDRIA VA 22302

JAMES T MYRICK  
EMERSON ELECTRIC CO.  
DIR PLANNING & ESTIMATING  
8100 W FLORISSANT STA 3131  
ST LOUIS MO 63136

LEON Q. NEWTON  
MARTIN MARIETTA  
MGR MATL COST MGMT  
5539 HOLLOW OAK RD  
ORLANDO FL 32808

JACK NUNN  
FN MANUFACTURING INC  
P O BOX 104  
COLUMBIA SC 29202

HARRY F. NYE  
BMY  
MGR COST & BUDGETS  
P O BOX 1512  
YORK PA 17405

W OTTO  
EATON CORP, AIL DIV  
FINANCIAL , MGR  
COMMACK ROAD  
DEER PARK NY 11729

H. W. PARTMA  
JET PROPULSION LABORATORY  
4800 OAK GROVE DR  
MS 180-604  
PASADENA CA 91109

HENRY J. PINCZOWER  
SINGER  
LIBRASCOPE DIV  
833 SONORA AVENUE  
GLENDALE CA 91201

JAMES H PROBUS  
DEPT OF THE NAVY  
SPEC ASSIST PROG BUD ANA SUP  
RM 5E779 THE PENTAGON  
WASHINGTON DC 20350

ROBERT P ROBICHAU  
SIMMONDS PRECISION  
DIR MILITARY PROGRMS  
8145 RAPHEL CT  
MANASSAS VA 22111

LAWRENCE L ROSENDORF  
HQ ARRADCOM  
ACTG DEPUTY C  
PROGRAM MANAGEMENT OFFICE  
DOVER NJ 07801

ALBERT RUGGIS  
USA CECOM  
CHF COST ANALYSIS  
ATTN DRSEL-CP-CA  
FT MONMOUTH NJ 07703

JANET E SARGENT  
NAVAL ORDNANCE STATION  
PROG MGMT OFFICE  
INDIAN HEAD MD 20610

MICHAEL M. SHAW  
BRITISH EMBASSY  
AIRFRAME OFFICE  
3100 MASS AVE NW  
WASHINGTON DC 20008

FRED SHEFFEY  
VOUGHT CORP  
DIR OF ENG ADMIN-MSL & SFC  
P O BOX 225907/MS TH-52  
DALLAS TX 75253

JOSEPH L SHOYTUSH  
SINGER/LINK  
MGR OF PLNG  
LINK FLIGHT SIMULATION DIV  
BINGHAMTON NY 13902

CRAIG C SINGER  
SYSTEMS PLANNING & ANAL-S1B  
ANALYST  
5203 LEESBURG PIKE STE E-17  
FALLS CHURCH VA 22041

GARY L SORRELL  
MGMT CONSULTING & REE INC  
5113 LEESBURG PIKE  
SUITE 509  
FALLS CHURCH VA 22041

NORMAN STANDARD  
USAARVADCOM  
4300 GOODFELLOW BLVD  
ST LOUIS MO 63120

T. L. STONE  
SINGER LINK SIMULATION  
DIR FINANCE  
COLESVILLE RD  
BINGHAMTON NY 01390

LTC A. J. STREMIC (RET)  
ADVANCED TECHNOLOGY INC  
7923 JONES BRANCH DRIVE  
MCLEAN VA 22102

ROBERT TOWNSEND  
AVCO  
V.P. FINANCE  
201 LOWELL ST  
WILMINGTON MA 01887

ROBERT E. VERGE  
SCIENCE APPLICATIONS INC  
MGR COST EST  
3191 MAGUIRE BLVD, STE 100  
ORLANDO FL 32803

WILLIAM WALLACE  
HQ DA  
SENIOR ENGR, ENGR TM  
DAMA-CSS, RM 3D422, PENTAGON  
WASHINGTON DC 20310

ROBERT D. WEIDENMULLER  
HQ DARCOM  
ATTN DRCCP-E, CHF COST ANAL  
5001 EISENHOWER AVE RM 3934  
ALEXANDRIA VA 22333

COL JAMES B. WELSH  
US ARMY TACOM  
PROGRAM MANAGER  
ATTN: DRCPM-PG  
WARREN MI 48090

THOMAS S. WIED  
GENERAL DYNAMICS/POMONA DIV  
VP CONTRACT & ESTIMATING  
P O BOX 2507 MZ 1-52  
POMONA CA 91769

GEORGE J. WOODITCH  
US GAO  
NATL SECURITY AND INTERNATL  
AFFAIRS DIVISION  
WASHINGTON DC 20548

WILLIAM J. YUKNAVICH  
MARTIN MARIETTA AEROSPACE  
MGR ESTIMATING CENT FINANCE  
PO BOX 5837 MP 387  
ORLANDO FL 32855

D. B. STRINGHAM  
FORD AEROSPACE  
DIR ACCTG P O BOX 43342  
300 RENAISSANCE CENTER  
DETROIT MI 48243

DR. KATSUAKI TERASAWA  
JET PROPULSION LAB  
SUPER ECONO & POLICY ANALYSIS  
4800 OAK GROVE DR M/S 506-2-1  
PASADENA CA 91109

F. B. WADE  
GOODYEAR AEROSPACE  
ESTIMATOR PROD LINE  
P O BOX 85  
LITCHFIELD PK AZ 85340

LARRY P. WAGGONER  
US ARMY  
OPERATION RES ANALYST  
ABERDEEN PROVING GROUD  
ABERDEEN MD 21005

BG CARLTON P. WEIDENTHAL  
USA TACOM  
DEP COMMANDING GENERAL  
WARREN MI 48090

WALTER WEISSE  
HAMILTON STANDARD DIV/UTC  
MGR OPERATIONS ENG  
BRADLEY RD M/S 1-B-2  
WINDSOR LOCKS CT 06095

ROBERT WILSON  
COLT FIREARMS  
P O BOX 1868  
HARTFORD CT 06102

DR RAYMOND F. WOJCIESZAK  
GENERAL ELECTRIC CO  
MGR MFG TECH ASSESSMENT  
1 NEUMANN WAY  
CINCINNATI OH 45215

BENJAMIN ZYCHER  
JET PROPULSION LAB  
ECONOMIST  
4800 OAK GROVE DR M/S 506-214  
PASADENA CA 91109



A hand-drawn diagram in black ink. It features a large circle on the left and two smaller circles on the right. A horizontal line connects the top of the large circle to the top of the two smaller circles.

7 - 86